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ILLUSTRATIONS OF FUNGI—I

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Each number of this journal will contain a plate representing certain species of fungi in their natural colors. The photographic work for these illustrations is being done by Mr. F. C. Berte and the color work by Mr. E. C. Volkert. Technical descriptions and notes of interest will accompany each plate.

Hypholoma perplexum (Peck) Sacc.

PERPLEXING HYPHOLOMA

Plate 1. Figure 1. $\times \frac{2}{3}$

Pileus 5–8 cm., convex to nearly plane, smooth, glabrous, dry, slightly umbonate at times, latericeous to bay, the margin cream-colored to ochraceous; flesh of mild flavor, white or nearly so, becoming yellowish with age; gills adnate, somewhat rounded, sometimes slightly decurrent, thin, narrow, crowded, pale yellow, becoming greenish, and finally purplish-brown from the ripening spores, which are ellipsoid, smooth, purplish-brown, 7–8 $\times$ 4 μ; stipe 6–10 cm. long, 5–7 mm. thick, subequal, firm, hollow, slightly fibrillose, stramineous above, ochraceous or reddish below, ornamented with an arachnoid ring when young, which becomes conspicuous by reason of the spores which collect upon it.

This species occurs abundantly on stumps and roots of deciduous trees in autumn, appearing in conspicuous reddish clusters of considerable size. It is edible, but not very good in quality, being useful because of its very late appearance. Peck separated it in 1872 from *H. sublateritium* chiefly because it lacked the bitter taste ascribed to that species, of which it may be only a form.

In collecting this species for food, young and fresh specimens of mild flavor should be selected, and they should be cooked for at least thirty minutes.

Armillaria mellea (Vahl) Quél.

HONEY AGARIC

Plate 1. Figure 2. × ½

Pileus convex to expanded, 4–12 cm. broad, very variable, usually dry, smooth or becoming striate toward the margin, pale honey-yellow to dark reddish-brown, usually adorned with minute tufts of brown or blackish hairs, which are more abundant on the disk; flesh white or whitish, somewhat acrid and unpleasant to the taste; gills adnate or decurrent, white or whitish, becoming discolored or spotted with age; spores ellipsoid, smooth, hyaline, 7–10 μ long; ring white, cottony, with dark specks, or thin, arachnoid and evanescent; stem melleous, reddish-brown or dirty-brown below, paler above, nearly equal, firm, fibrous, spongy within, usually floccose-scaly below the ring, 4–12 cm. long, 5–15 mm. thick.

Very widely distributed and very abundant on stumps and buried roots of both deciduous and evergreen trees, on which it grows as a parasite, the sporophores appearing in dense clusters in autumn and the shining brown cords or *rhizomorphs* being often seen in dead logs and stumps. To the forester this is probably the most important species of all the gill-fungi. It is also much used as an article of food in Europe and about New York City, although of inferior quality.

Tricholoma equestre (L.) Quél.

EQUESTRIAN TRICHOLOMA

Plate 1. Figure 3. × ½

Pileus convex to expanded, depressed at the center, 8–12 cm. broad, yellowish or reddish, the disk darker, glabrous or slightly scaly, margin flexuous; flesh white or slightly yellowish, rather unpleasant in flavor; gills broad, nearly free, rounded behind, close, sulphur-yellow; spores ellipsoid, smooth, hyaline, 6–8 × 4–5 μ; stipe short, thick, solid, variable in shape, white with yellow or red markings, 3–6 cm. long, 1–2 cm. thick.

This edible species is conspicuous and beautiful, but not abun-

dant. It occurs in autumn in sandy soil under or near evergreen trees in Europe and the northeastern United States.

Clitocybe multiceps Peck

MANY-HEADED CLITOCYBE

Plate 1. Figure 4. × ½

Pileus 3–8 cm. broad, convex to expanded, smooth, glabrous, watery-white to pale avellaneous-isabelline, the disk more grayish; flesh milk-white, mild, somewhat oily, firm and persistent; gills adnate or slightly decurrent, rarely sinuate, white or pale stramineous, close and narrow; spores globose, smooth, hyaline, 5–7 μ; stipe 5–10 cm. long, 7–15 mm. thick, cylindrical, equal, solid or stuffed, firm, white or pale stramineous, pruinose above.

This species occurs in wet weather in dense clusters on lawns, especially in rather long grass, and is usually found in great abundance when found at all. Its flesh is firm, with a slight oily flavor, and sporophores may be kept for several days before cooking. It is known only from New York and a few adjoining states, but should stand transplanting in sod rather easily. Having used it in quantity from my own lawn, I can recommend it as a valuable edible species.

Boletus scaber Bull.

ROUGH-STEMMED BOLETUS

Plate 1. Figure 5. × ½

Pileus convex, 3–12 cm. broad, very variable in color, white, red or brown, usually smooth and glabrous; flesh white, becoming slightly darker or flesh-colored when bruised; tubes long, slender, depressed about the stem, white or stramineous, becoming brownish with age and flesh-colored or blackish when bruised; spores oblong, smooth, brown, 13–16 μ long; stem firm, solid, tapering upward, 5–15 cm. long, 1–2 cm. thick, whitish, roughened with numerous reddish or brownish dots or scales.

This is a very handsome edible species and the most abundant of the fleshy tube-bearing fungi, being found on the ground in woods or groves from June to November. Most of the boleti are edible, but a few are considered dangerous and should be well known by the beginner before any specimens of the group are collected for food.

THE BOLETACEAE OF NORTH AMERICA—I

WILLIAM A. MURRILL

The Boletaceae are fleshy tube-bearing fungi, terrestrial for the most part, and, with one or two exceptions, centrally stipitate. They differ from the Polyporaceae chiefly in their fleshy consistency and terrestrial habit. Most of them are edible, but a few species are said to be distinctly poisonous.

The family shows few lines of cleavage, although a number of genera have been proposed since Linnaeus included all tube-bearing fungi in the single genus *Boletus*. S. F. Gray, in 1821, divided the group into three genera, *Suillus, Pinuzza* and *Leccinum*. *Strobilomyces* was separated by Berkeley in 1860, and *Boletinus* by Kalchbrenner in 1877. More recently, Karsten, Quélet, and Patouillard have each originated or adopted a system of classification for the group involving a number of genera, which will be discussed in their proper order in the following pages.

Synopsis of the North American Genera

Tubes arranged in radiating rows.	
Stipe annulate.	1. *Boletinus.*
Stipe exannulate.	2. *Boletinellus.*
Tubes not arranged in radiating rows.	
Stipe either glandular-dotted or annulate.	
Stipe annulate, glandular-dotted in some species.	
Spores brownish-black, rough, subglobose.	3. *Strobilomyces.*
Spores ochraceous to yellowish-brown, smooth, usually oblong-ellipsoid.	
Sporophore covered with a conspicuous yellow powder.	4. *Pulveroboletus.*
Sporophore not covered with a yellow powder.	
Pileus floccose-verrucose, dry.	5. *Boletellus.*
Pileus smooth, viscid.	6. *Boletus.*
Stipe glandular-dotted, exannulate.	7. *Rostkovites.*
Stipe neither glandular-dotted nor annulate.	
Spores hyaline, often becoming yellowish; stem hollow, not reticulated.	8. *Gyroporus.*

Spores rosy or flesh-colored; stem solid, usually reticulated. 9. *Tylopilus.*
Spores ochraceous to yellowish-brown.
Mouths of tubes red or reddish-brown, tubes yellowish within. 10. *Suillellus.*
Mouths of tubes never uniformly red nor reddish-brown, tubes unicolorous. 11. *Ceriomyces.*

1. BOLETINUS Kalchbr. Icon. Sel. Hymen. Hung. **4**: 52. *pl. 31.* 1877

Euryporus Quél. Ench. Fung. 163. 1886. (Type species, *Euryporus cavipes* (Opat.) Quél.)

Boletopsis P. Henn. Engl. & Prantl, Natur. Pflanz. **1**^{1**}: 194. 1899. Metonym.

Hymenophore annual, terrestrial or rarely epixylous, centrally stipitate; surface dry, minutely silky to fibrillose or squamose: context whitish or yellowish, fleshy or spongy; tubes large, shallow, elongated, tough, not easily separating, radiately arranged, adnate or slightly decurrent, yellowish, covered with a veil: spores elongated, smooth, yellowish-brown to purplish-brown, sometimes with greenish tints: stipe more or less annulate, spongy or hollow within.

Type species, *Boletus cavipes* Opat.

Stipe hollow; pileus tawny-brown, fibrillose-squamulose. 1. *B. cavipes.*
Stipe solid.
Pileus whitish or grayish, slightly squamulose. 2. *B. grisellus.*
Pileus yellow or yellowish.
Pileus 5 cm. or less broad. 3. *B. Berkeleyi.*
Pileus 10 cm. or more broad. 4. *B. appendiculatus.*
Pileus red or reddish, conspicuously squamose.
Spores purplish-brown; scales scattered. 5. *B. spectabilis.*
Spores ochraceous-brown; scales dense. 6. *B. pictus.*

1. BOLETINUS CAVIPES (Opat.) Kalchbr. Icon. Sel. Hymen. Hung. 52. *pl. 31.* 1877

Boletus cavipes Opat. Comm. de fam. fung. Bolet. 11. 1836.

Boletus ampliporus Peck, Ann. Rep. N. Y. State Mus. **26**: 67. 1874. (Type from North Elba, New York.)

This species occurs sparingly in this country in New England and New York, usually in swamps or damp mossy places. It was at first referred to *B. subtomentosus* by Peck.

2. BOLETINUS GRISELLUS Peck, Mem. N. Y. State Mus. **3**: 169. *pl 52. f. 13–19.* 1900

This rare species was described from specimens collected by Morris at Natick, Ellis, and Waltham, Massachusetts. It grows under or near tamarack trees, and develops late in the season.

3. **Boletinus Berkeleyi** nom. nov.

Boletus decipiens B. & C. Ann. Mag. Nat. Hist. II. **12**: 430. 1853. Not *Boletus decipiens* Schrad. 1794.

Boletinus decipiens Peck, Bull. N. Y. State Mus. **2**: 78. 1889.

This species occurs in thin woods along the Atlantic seaboard from New Jersey to Florida. The central stem and much broader, ochraceous-ferruginous spores distinguish it from *B. merulioides* in dried plants where the veil may be inconspicuous.

4. BOLETINUS APPENDICULATUS Peck, Bull. Torrey Club **23**: 418. 1896

Only a single pileus remains of the type specimen collected by Yeomans under fir trees in Washington, D. C. Peck's description is as follows:

"Pileus fleshy, convex, glabrous, ochraceous-yellow, the margin appendiculate with an incurved membranous veil, flesh pale-yellow, unchangeable; tubes rather small, yellow, their mouths angular, unequal, becoming darker or brownish where wounded; stem solid, slightly thickened at the base, yellow; spores pale-yellow, oblong, .0004 to .0005 in. long, about .00016 broad; pileus 4 to 8 in. broad; stem 2 to 3 in. long, 4 to 6 lines thick."

5. BOLETINUS SPECTABILIS Peck, Ann. Rep. N. Y. State Mus. **23**: 128. *pl. 6. f. 1–3.* 1872

This showy species occurs sparingly in exposed northern swamps in Canada and the northern United States from New England and New York to Wisconsin. The pileus is adorned with conspicuous red scales; the flesh and tubes are yellow, the latter soon colored darker by the purplish-brown spores.

6. BOLETINUS PICTUS Peck, Bull. N. Y. State Mus. **2**: 77. 1889

Boletus pictus Peck, Ann. Rep. N. Y. State Mus. **23**: 128. 1872.

Boletus Spraguei B. & C. Grevillea **1**: 35. 1872. (Type from New England.)

This beautiful species, described from New York by Peck, is rather common in the woods and mossy swamps of the mountainous regions of the eastern United States and Canada. It is distinguished from *B. spectabilis* by its lighter-colored spores and the denser covering of reddish, fibrillose scales on the surface of its cap.

DOUBTFUL SPECIES

Boletinus borealis Peck, Bull. Torrey Club **22**: 206. 1895. Described from dried specimens collected by Waghorne on Capstan Island, Labrador. The types at Albany resemble *B. cavipes*.

2. **Boletinellus** gen. nov.

Hymenophore annual, terrestrial or sometimes attached to buried roots, pileus circular, varying to dimidiate at times; surface dry, minutely tomentose to floccose-tomentose: context white or yellowish, fleshy; tubes decurrent, large, shallow, elongated, not easily separating, radiating, yellow, not covered with a veil: spores elipsoid, smooth, some shade of brown: stipe central, eccentric or lateral, solid, fleshy or spongy.

Type species, *Boletinus porosus* Peck.

Stem eccentric or lateral; pileus reddish-brown, glabrous or minutely tomentose.	1. *B. merulioides.*
Stem central.	
Pileus dark chestnut, subtomentose.	2. *B. castanellus.*
Pileus bright red, floccose-tomentose.	3. *B. paluster.*

1. **Boletinellus merulioides** (Schw.)

Daedalea merulioides Schw.; Proc. Acad. Sc. Phila. **4**: 160. 1832.

Paxillus porosus Berk.; Lea, Cat. Cinn. Plants 54. 1849.

Boletus lateralis Bundy, Geol. Wisc. **1**: 398. 1883.

Boletinus porosus Peck, Bull. N. Y. State Mus. **2**: 79. 1889.

This species is well known throughout the eastern United States from Canada to Alabama and as far west as Wisconsin. It occurs gregariously in low wet places, especially about stumps and decaying roots, where there is partial shade. In the speci-

men described by Schweinitz the stipe was reduced to a mere tubercle and the pileus was dimidiate in shape.

2. **Boletinellus castanellus** (Peck)

Boletinus castanellus Peck, Bull. Torrey Club **27**: 613. 1900. (Type from New Jersey.)

This species, the type of which I have not seen, was described as follows from specimens collected by Mr. E. B. Sterling in New Jersey:

"Pileus convex or nearly plane, dry, subtomentose, soft, spongy, dark chestnut, flesh whitish or yellowish-white; tubes nearly plane in the mass, adnate or slightly decurrent, brown, their mouths large, angular; stem short, solid, glabrous, colored like the pileus, whitish or grayish within, slightly reticulate at the top; spores 7.5–10 μ long, about 5 μ broad.

"Pileus 2.5–4 cm. broad; stem about 2.5 cm. long, 4–8 mm. thick."

3. **Boletinellus paluster** (Peck)

Boletus paluster Peck, Ann. Rep. N. Y. State Mus. **23**: 132. *pl. 6. f. 4–7.* 1872. (Type from North Elba, New York.)

Boletinus paluster Peck, Bull. N. Y. State Mus. **2**: 78. 1889.

This attractive little species occurs in wet places, usually among moss, and is readily known by its brilliant color and the entire absence of an annulus. It has been collected in Ontario, Maine, Massachusetts, New York, and New Jersey.

3. STROBILOMYCES Berk. Outl. Brit. Fung. 236. 1860

Eriocorys Quél. Ench. Fung. 163. 1886. (Type species, *Eriocorys strobilacea* (Scop.) Quél.)

Hymenophore annual, terrestrial, centrally stipitate; surface of pileus and stipe blackish and shaggy: context white, at first fleshy, becoming tough; tubes angular, adnate, white when young, covered with a floccose veil: spores globose or broadly ellipsoid, rugulose, blackish-brown: stipe solid, not reticulate.

Type species, *Strobilomyces strobilaceus* (Scop.) Berk.

1. STROBILOMYCES STROBILACEUS (Scop.) Berk. Outl. Brit. Fung. 236. 1860

Boletus strobilaceus Scop. Anni Hist. Nat. **4**: 148. *pl. 1. f. 5.* 1770.

Boletus squarrosus Pers. Myc. Eur. **2**: 145. *pl. 19.* 1825.
Boletus coniferus Pers. Myc. Eur. **2**: 146. 1825.
Boletus strobiliformis Dicks. Crypt. **1**: 17. *pl. 3. f. 2.* 1785.
Boletus stygius Wallr. Fl. Crypt. **4**: 608. 1833.
Eriocorys strobilacea Quél. Ench. Fung. 163. 1886.

This common edible species is easily known by its black color and shaggy appearance. Its flesh is white, changing to reddish and finally to black when wounded. It is abundant on shaded banks in woods throughout Europe, Canada, and the United States.

DOUBTFUL SPECIES

Boletus coccineus Fries, Epicr. Myc. 423. 1838. Not *Boletus coccineus* Bull. 1791. This species, of doubtful affinities and doubtful locality, is based upon a brief description and a figure (Plum. Fil. Amer. *pl. 167. f. A.A.*). It is placed by Saccardo in the genus *Strobilomyces*.

4. **Pulveroboletus** gen. nov.

Hymenophore annual, terrestrial, centrally stipitate; surface of pileus and stipe clothed with a conspicuous sulphur-yellow, powdery tomentum, which may be the remains of a universal veil: context white, fleshy; tubes adnate, yellowish, covered with a large veil: spores oblong-ellipsoid, ochraceous-brown: stipe solid, annulate, not reticulate.

Type species, *Boletus Ravenelii* B. & C.

1. **Pulveroboletus Ravenelii** (B. & C.)

Boletus Ravenelii B. & C. Ann. Mag. Nat. Hist. II. **12**: 429. 1853.

This beautiful and interesting species was first described from the collections of Ravenel in South Carolina, and has since been collected in many of the eastern states from New England to the Gulf of Mexico. It differs from most other higher fungi in preferring deep shade, being often found in dense thickets of *Kalmia* and *Rhododendron*. The conspicuous veil and the yellow powder which covers the entire sporophore will readily distinguish this species.

5. **Boletellus** gen. nov.

Hymenophore annual, epixylous, centrally stipitate; surface floccose-verrucose, yellowish: context light-colored, fleshy; tubes

angular, depressed, yellowish, covered with a veil: spores oblong-ellipsoid, smooth, ferruginous: stipe solid, white, not reticulate.

Type species, *Boletus Ananas* Curtis.

1. **Boletellus Ananas** (Curtis)

Boletus Ananas Curtis, Am. Jour. Sci. & Arts, II. **6**: 351. 1848.

Boletus isabellinus Peck, Bull. Torrey Club **24**: 146. 1897. (Type from Mississippi.)

The characters of the genus will readily distinguish this species. It was for a long time known only from the Carolinas, but has more recently been collected many times in Alabama and Mississippi by Professor and Mrs. F. S. Earle, and once in Georgia by Dr. R. M. Harper. According to Professor Earle it always occurs either as a wound parasite on pine trunks or about the base of living pine trees. *Boletus isabellinus* Peck was described from undeveloped specimens.

6. BOLETUS (Dill.) L. Sp. Pl. 1177. 1753

Tubiporus Paul. Traité Champ. *pl. 166* (*bis.*). 1812–1835. (Type species, *Tubiporus annulatus* (Bull.) Paul.)

Suillus Poir. Encycl. Méth. Bot. **7**: 496. 1806. (Type species, *Suillus annulatus* Poir.)

Pinuzza S. F. Gray, Nat. Arr. Brit. Pl. **1**: 646. 1821. (Type species, *Boletus flavus* Bolt.)

Cricunopus Karst. Rev. Myc. **3**[9]: 16. 1881. (Type species, *Cricunopus luteus* (L.) Karst.)

Viscipellis Quél. Ench. Fung. 155. 1886. (Type species, *Viscipellis sphaerocephala* (Barla) Quél.)

Hymenophore annual, terrestrial, centrally stipitate; surface viscid, glabrous: context fleshy, white or yellowish; tubes adnate, small, angular, yellowish, covered with a whitish veil: spores oblong-ellipsoid, or rarely globose, smooth, yellowish-brown: stipe solid, annulate, often glandular-dotted.

Type species, *Boletus luteus* L.

Stem glandular-dotted.	
Stem not at all reticulate.	1. *B. luteus.*
Stem reticulate above the annulus.	2. *B. amabilis.*
Stem not glandular-dotted.	
Spores globose or subglobose.	3. *B. sphaerosporus.*
Spores oblong-ellipsoid.	4. *B. Clintonianus.*

1. BOLETUS LUTEUS L. Sp. Pl. 1177. 1753

Boletus annulatus Pers. Syn. Fung. 503. 1801.

Tubiporus annulatus Paul. Traité Champ. *pl. 166 (bis.)*. 1812–1835.

Boletus Elbensis Peck, Ann. Rep. N. Y. State Mus. **23**: 129. 1872. (Type from Elba, New York.)

Boletus salmonicolor Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 100. 1874. (Type from Vermont.)

Cricunopus luteus Karst. Rev. Myc. 3^9: 16. 1881.

Viscipellis luteus Quél. Ench. Fung. 155. 1886.

Boletus subluteus Peck, Bull. N. Y. State Mus. 1^2: 62. 1887. (Type from New York.)

Ixocomus luteus Quél. Fl. Myc. Fr. 414. 1888.

Boletus acidus Peck, Bull. N. Y. State Mus. no. **105**: 15. *pl. T. f. 1–6*. 1906. (Type from Port Henry, New York.)

This species is well known and widely distributed, occurring commonly in sandy soil in coniferous or mixed woods throughout the eastern United States and Europe, and probably extending around the globe in temperate regions. The cap is smooth, yellowish-brown, and very viscid; the tubes and stem are yellow, the latter glandular-dotted and also provided with a large annulus, which is the chief character distinguishing it from *R. granulatus*.

2. BOLETUS AMABILIS Peck, Bull. Torrey Club **27**: 612. 1900

Described from specimens collected by Bartholomew in dense spruce woods in Colorado. The cap is glabrous, reddish-tawny, and probably viscid when fresh; the tubes short, yellow, somewhat radiating, and decurrent; and the stem subequal, paler than the cap, and reticulate above the small whitish annulus. No. 340 of Clements' Crypt. Form. Colorad., distributed as "*Boletus bovinus unicolor* (Frost)," may be this species, but I have not seen satisfactory material of it, nor have I seen the type of *B. amabilis*.

3. BOLETUS SPHAEROSPORUS Peck, Bull. Torrey Club **12**: 33. 1885

This rare species was described from material collected near Madison, Wisconsin, by Trelease. It is known to occur also

in Iowa and Minnesota, being found in low ravines and sandy places in woods, and occasionally about stumps. The sheathing annulus is very characteristic, as are the globose spores, both characters being very rare among the Boletaceae.

4. BOLETUS CLINTONIANUS Peck, Ann. Rep. N. Y. State Mus. **23**: 128. *pl. 5. f. 1–5.* 1872

Boletus viridarius Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 100. 1874. (Type from Vermont.)

Boletus serotinus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 100. 1874. (Type from Vermont.)

This rather rare species was described from North Elba, New York, and is to be looked for in shaded grassy places in the northeastern United States and Canada. I have collected it twice in central Maine and once in Newfield, New Jersey, the latter collection being made as late as October 25. It is readily distinguished from its congeners of the eastern United States by the absence of glandular dots on the stem.

7. ROSTKOVITES Karst. Rev. Myc. **3**[9]: 16. 1881

Hymenophore annual, terrestrial, centrally stipitate; surface viscid, glabrous or hirtellous: context fleshy, yellowish; tubes adnate, angular, yellow, not covered with a veil, exuding viscid drops which blacken on drying: spores oblong-ellipsoid, smooth, yellowish-brown: stipe solid, glandular-dotted, exannulate, not reticulate.

Type species, *Rostkovites granulatus* (L.) Karst.

Pileus glabrous or nearly so.
- Pileus brown when moist, yellowish on drying; stem over 8 mm. in diameter. — 1. *R. granulatus.*
- Pileus yellow, often streaked with bright red; stem usually slender, 8 mm. or less in diameter. — 2. *R. Americanus.*

Pileus adorned with conspicuous tufts of hairs. — 3. *R. hirtellus.*

1. ROSTKOVITES GRANULATUS (L.) Karst. Rev. Myc. **3**[9]: 16. 1881

Boletus granulatus L. Sp. Pl. 1177. 1753.

Boletus circinans Pers. Tent. Disp. Meth. Fung. 27. 1797.

Boletus lactifluus With. Arr. Brit. Pl. ed. 4. **4**: 314. 1801.

Leccinum lactifluum S. F. Gray, Nat. Arr. Brit. Pl. **1**: 647. 1821.

Boletus collinitus Peck, Ann. Rep. N. Y. State Mus. **23**: 129. 1872.

Boletus albus Peck, Ann. Rep. N. Y. State Mus. **23**: 130. 1872. (Type from the Adirondacks, New York.)

Boletus viscosus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 101. 1874. (Type from Vermont.) Not *B. viscosus* Venturi.

Boletus punctipes Peck, Ann. Rep. N. Y. State Mus. **32**: 32. 1879. (Type from Gansevort, New York.)

Boletus brevipes Peck, Ann. Rep. N. Y. State Mus. **38**: 110. 1885.

Viscipellis granulata Quél. Ench. Fung. 156. 1886.

Ixocomus granulatus Quél. Fl. Myc. Fr. 412. 1888.

This species is common in Europe and throughout the United States and Canada, occurring in scattered groups in open woods, especially under or near pine trees. The surface of the cap is very viscid and usually of a brownish color when moist, becoming yellow on partial drying; the stem and tubes are yellowish, and exude viscid dots which become black on drying. There is an albino form, to which Peck gave the name *Boletus albus*. In *Boletus viscosus* of Frost, the stem is rather shorter than usual, a character which Peck kept in mind when he rechristened the species *Boletus brevipes*.

2. **Rostkovites subaureus** (Peck)

Boletus subaureus Peck, Ann. Rep. N. Y. State Mus. **39**: 42. 1886. (Type from Day, New York.)

Boletus Americanus Peck, Bull. N. Y. State Mus. **1**^{2}: 62. 1887. (Type from New York.)

Boletus flavidus Peck, Ann. Rep. N. Y. State Mus. **23**: 129. 1872.

This species resembles *R. granulatus* in appearance and also in habitat. It does not occur in Europe, although it has very commonly been referred to *B. flavidus*. In its usual form, the cap is yellow and dotted or streaked with brilliant red, the stem being slender, yellow, and covered with reddish-brown, viscid dots which become black on drying. There are forms, however, which are distinguished with difficulty from *R. granulatus*.

3. **Rostkovites hirtellus** (Peck)

Boletus hirtellus Peck, Bull. N. Y. State Mus. **2**: 94. 1889. (Type from New York.)

This rare species was at first confused by Peck with *R. subaureus,* but it is easily recognized by its hirtellous pileus. It is known to occur in sandy soil under pines in New York and Connecticut.

8. GYROPORUS Quél. Ench. Fung. 161. 1886

Suillus Karst. Bidr. Finl. Nat. och Folk **37**: 1. 1882. (Type species, *Suillus cyanescens* (Bull.) Karst.)

Hymenophore annual, terrestrial, centrally stipitate; surface dry, minutely tomentose to floccose-squamose: context white, less compact than in most members of the family and therefore drying more readily; tubes free, small, cylindrical, white, not covered with a veil: spores ellipsoid, smooth, white, at length pale-yellow: stipe soft and spongy within, usually becoming hollow.

Type species, *Gyroporus cyanescens* (Bull.) Quél.

Flesh quickly changing to blue when wounded; pileus grayish-yellow, floccose. 1. *G. cyanescens.*

Flesh white, unchangeable; pileus reddish-brown, nearly glabrous. 2. *G. castaneus.*

1. GYROPORUS CYANESCENS (Bull.) Quél. Ench. Fung. 161. 1886

Boletus cyanescens Bull. Herb. Fr. *pl. 369.* 1787.
Boletus constrictus Pers. Syn. Fung. 508. 1801.
Leccinum constrictum S. F. Gray, Nat. Arr. Brit. Pl. 647. 1821.
Boletus lacteus Lév. Ann. Sci. Nat. III. **9**: 124. 1848.
Suillus cyanescens Karst. Bidr. Finl. Nat. och Folk **37**: 1. 1882.

This is a very distinct species, easily known by the deep-blue color which its flesh and tubes assume when wounded. It occurs quite commonly in woods and open places throughout eastern Canada and the northern United States from Maine to Minnesota and south to North Carolina.

2. GYROPORUS CASTANEUS (Bull.) Quél. Ench. Fung. 161. 1886

Boletus castaneus Bull. Herb. Fr. *pl. 328.* 1786.
Suillus castaneus Karst. Bidr. Finl. Nat. och Folk **37**: 1. 1882.

This species is quite common in sandy soil in open woods throughout this country and Europe. It is one of the few boleti that dry easily, the same being true also of *G. cyanescens*.

9. TYLOPILUS Karst. Rev. Myc. **3**°: 16. 1881

Dictyopus Quél. Ench. Fung. 159. 1886. (Type species, *Dictyopus felleus* (Bull.) Quél.)

Rhodoporus Quél. Fl. Myc. Fr. 420. 1888. (Type species, *Rhodoporus felleus* (Bull.) Quél.)

Hymenophore annual, terrestrial or rarely epixylous, centrally stipitate; surface dry, glabrous or minutely tomentose: context white, fleshy, sometimes bitter; tubes small, angular, white, becoming flesh-colored from the spores, not covered with a veil: spores oblong-ellipsoid, smooth, rosy or flesh-colored, rarely inclining to ferruginous: stipe solid, even or reticulated.

Type species, *Tylopilus felleus* (Bull.) Karst.

Pileus yellow to brown.
  Sporophore large; stipe 1 cm. or more thick.
    Context decidedly bitter. 1. *T. felleus.*
    Context not bitter. 2. *T. indecisus.*
  Sporophore usually small; stipe about 5 mm. thick, never reticulate. 3. *T. gracilis.*
Pileus black or blackish; tubes becoming blackish when wounded. 4. *T. alboater.*

1. TYLOPILUS FELLEUS (Bull.) Karst. Rev. Myc. **3**°: 16. 1881

Boletus felleus Bull. Herb. Fr. *pl. 379.* 1787.

? *Boletus modestus* Peck, Ann. Rep. N. Y. State Mus. **25**: 81. 1873. (Type from New York.)

Boletus ferrugineus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 104. 1874.

Dictyopus felleus Quél. Ench. Fung. 159. 1886.

Rhodoporus felleus Quél. Fl. Myc. Fr. 420. 1888.

This species is abundant and widely distributed both in this country and in Europe. Specimens have been frequently found over a foot in diameter. It is said to be poisonous.

2. **Tylopilus indecisus** (Peck)

Boletus indecisus Peck, Ann. Rep. N. Y. State Mus. **41**: 76. 1888.

This species was described from Menands, New York, and has since been reported from New Jersey, Pennsylvania, Kentucky, and North Carolina. I have found it in several localities, usually in thin deciduous woods. Specimens referred to *B. alutarius* Fr. by American collectors probably belong in this category; but it is difficult to distinguish either species from *T. felleus*, except by taste.

3. TYLOPILUS GRACILIS (Peck) P. Henn.

Boletus gracilis Peck, Ann. Rep. N. Y. State Mus. **24**: 78. 1872.

This is usually a small plant, of slender habit, occurring in woods on the ground or on much decayed logs or stumps. It sometimes attains a diameter of 6 cm., but is easily distinguished, even when of maximum size, by its subferruginous spores. The type specimens were collected near Garrisons, New York; it has since been collected in Nova Scotia, New England, New York, Pennsylvania, West Virginia, North Carolina, Georgia, and a few other eastern states.

4. **Tylopilus alboater** (Schw.)

Boletus alboater Schw. Schr. Nat. Ges. Leipzig **1**: 95. 1822.
Boletus nigrellus Peck, Ann. Rep. N. Y. State Mus. **29**: 44. 1878. (Type from Sandlake, New York.)

This species is not often collected, but is easily recognized when once seen. It occurs in open deciduous woods in the eastern United States from New York to Mississippi. The type collection was made in North Carolina, and the description was evidently drawn from young plants before the white tubes had been colored by mature spores.

10. **Suillellus** gen. nov.

Hymenophore annual, terrestrial, centrally stipitate; surface glabrous or nearly so, dry or slightly viscid: context white or yellow, fleshy, very firm, considered poisonous; tubes usually free, small, yellowish within, their mouths closed when young, and red or orange from the first, not covered with a veil: spores oblong-ellipsoid, smooth, yellowish-brown, sometimes with greenish tints: stipe solid, usually reticulated or dotted.

Type species, *Boletus luridus* Schaeff.

Flesh quickly and distinctly changing to blue when wounded. 1. *S. luridus.*
Flesh scarcely changing color when wounded; pileus shining, blood-red; stipe blood-red, conspicuously reticulated. 2. *S. Frostii.*

1. **Suillellus luridus** (Schaeff.)

Boletus luridus Schaeff. Fung. Bav. **3**: *pl. 107.* 1770.
Boletus tuberosus Bull. Herb. Fr. *pl. 100.* 1782.
Boletus rubeolarius Bull. Herb. Fr. 326. *pl. 490. f. 1.* 1791.
Boletus Satanas Rostk. in Sturm, Deutsch. Fl. **5**: 97. *pl. 31.* 1844.
Boletus Sullivantii B. & C. Syll. Crypt. 152. 1856. (Type from Ohio.)
Boletus vermiculosus Peck, Ann. Rep. N. Y. State Mus **23**: 130. 1872. (Type from New Baltimore, New York.)
Boletus magnisporus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 103. 1874. (Type from Vermont.)
Boletus firmus Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 103. 1874. (Type from Vermont.)
Boletus Spraguei Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 103. 1874. (Type from Vermont.) Not *B. Spraguei* B. & C. 1872.
Boletus subvelutipes Peck, Bull. N. Y. State Mus. **2**: 142. 1889. (Type from New York.)
Boletus Underwoodii Peck, Bull. Torrey Club **24**: 145. 1897. (Type from Alabama.)
Boletus chamaelcontinus Atk. Jour. Myc. **8**: 112. 1902. (Type from Cayuga Lake, New York.)

This species is abundant, widely distributed, and exceedingly variable, especially in the color of the cap and in the surface characters of the stem. I have usually found it on clay banks or roadsides in open deciduous woods, but it has been reported from many different habitats. It has been generally considered poisonous, and should be regarded at least as suspicious.

2. **Suillellus Frostii** (Russell)

Boletus Frostii Russell; Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 102. 1874. (Type from Vermont.)
Boletus alveolatus B. & C.; Frost, Bull. Buffalo Soc. Nat. Hist. **2**: 102. 1874. (Type from New England.)

This very handsome species was collected by Frost in considerable quantity near Brattleboro, Vermont, and is known to occur sparingly also in Connecticut, New York, New Jersey, Pennsylvania, District of Columbia, Tennessee, and Indiana. Its favorite habitat is thin oak woods, where the light is sufficient to enable grass to grow. Specimens collected by Sprague were returned by Berkeley under the name *B. alveolatus* B. & C., which was published by Frost with a description. Meanwhile, Berkeley had decided that the plant was only a form of *B. edulis* (Grevillea **1**: 36. 1872.)

DOUBTFUL SPECIES

Boletus parvus Peck, Bull. Torrey Club **24**: 145. 1897. Described from specimens collected by L. M. Underwood in grassy woods near Auburn, Alabama. I have been unable to find the types of this species either at Albany or New York.

NOTES ON NORTH AMERICAN HYPOCREALES—I. NEW AND NOTEWORTHY SPECIES

FRED J. SEAVER

The genus *Hyponectria,* founded by Saccardo in 1878, differs from *Nectriella* in the subepidermal character of the perithecia. Six species have been referred by Saccardo to this genus, in various volumes of his Sylloge Fungorum, one of which, *Hyponectria Gossypii* (Schw.) Sacc., the only North American representative of the genus, has since been shown not to be a fungus at all.* This leaves the genus, at present, entirely unrepresented in North America so far as the records show.

In working over the material in the Ellis collection at the New York Botanical Garden, one species, *Nectriella Cacti* Ellis & Everh., has been found to show the true hypodermal character of the perithecia and should be referred to this genus. The ostiola form disc-like expansions above the surface of the epidermis but the perithecia themselves, while prominent, are covered by the thin epidermis of the host, a fact which was not mentioned by Mr. Ellis in his original description and one which apparently escaped his notice.

One species of this genus has also been collected by the writer in North Dakota on dead stems of herbaceous plants. As in the preceding, the perithecia of this species are prominent, though covered, forming minute, orange pustules scattered over the surface of the host. The ostiola also form the disc-like, slightly hairy expansions above the surface of the epidermis. This form is distinct in its spore characters from the preceding as well as from any of the species which have been previously described as representative of this small genus and is here offered as new, being now one of the two representatives of the genus for North America.

* U. S. Dept. Agric. Div. Veg. Phys. Path. Bull. 17: 51. 1899.

In addition to the above, one species of *Nectria* was collected and studied by the writer during the autumn of 1906 which it is thought best to describe at this time. The plants occur on partially decayed seeds of skunk-cabbage (*Spathyema foetida*) and were collected commonly during the autumn of the above date in a swampy place in the vicinity of New York City. The conidial phase which forms a whitish or pinkish mass over the surface of the decaying seeds, has much the gross appearance of some of the common species of *Fusarium* but differs in its microscopic details. The perithecia later appear in small clusters seated on the stromata formed by the conidial phase of the plant. During the past season, 1908, the locality in which this species was originally collected was visited once, but at that time none of the plants were found.

HYPONECTRIA Sacc. Michelia **1**: 250. 1878

Perithecia globose or subglobose, subepidermal, often becoming erumpent; asci 8-spored; spores elliptical or subelliptical, hyaline, simple. Distinguished from *Charonectria* by the simple spores.

Type species: *Hyponectria Buxi* (DC.) Sacc.

Spores 5–6 × 1.5–2 mic., on stems of *Opuntia* sp. 1. *H. Cacti.*
Spores 10 × 2–2.5 mic., on herbaceous stems. 2. *H. dakotensis.*

1. **Hyponectria Cacti** (Ellis & Everh.)

Nectriella Cacti Ellis & Everh. Jour. Myc. **8**: 66. 1902.

Perithecia minute, scattered, subepidermal, globose or subglobose, expanded above the epidermis into a disc-like ostiolum, perithecia red, with ostiolum lighter, whitish (in preserved specimens), about 200 mic. in diameter; asci cylindrical to clavate, 8-spored, 40–50 × 3–4 mic.; spores 2-seriate, simple, hyaline, straight or curved, 5–6 × 1.5–2 mic.

On stems of *Opuntia* sp.

TYPE LOCALITY: Alabama.

DISTRIBUTION: Known only from type locality.

SPECIMENS EXAMINED: Alabama, *Carver 584* (type).

2. **Hyponectria dakotensis** sp. nov.

Perithecia scattered or occasionally 2 or more in close contact, subepidermal, becoming more or less erumpent, long, covered

by the thin, whitish epidermis of the host, scattered over whitish patches on the substratum; ostiolum forming a disc-like expansion above the surface of the epidermis, with a distinct perforation in the center, slightly hairy, especially near the margin of the disc, where the hairs appear as a delicate fringe; perithecia 200 mic. in diameter; asci clavate, 8-spored, 30–45 × 5 mic.; spores mostly 2-seriate above, often 1-seriate below, fusoid, with usually 2 large oil-drops, and 1–2 smaller ones toward either end, 10 × 2–2.5 mic., paraphyses present, delicate.

On herbaceous stems (*Ambrosia trifida?*).

TYPE LOCALITY: Fargo, N. Dakota.

DISTRIBUTION: Known only from type locality.

The perithecia of the present species are so minute that they are easily overlooked and were first noted in connection with the study of other species of fungi. They are scattered over whitish patches on the surface of the substratum and although the substratum is whitened where the perithecia occur there is apparently no superficial mycelial growth. Two collections of the species were made by the writer in the same locality near Fargo.

The genus *Charonectria* Sacc. differs from the present genus in possessing septate instead of simple spores. The presence or absence of the septum in case of very small spores is sometimes difficult to determine and in the North Dakota specimen the spores which have two large oil-drops often appear to be septate but no definite septum could be made out. The genus *Charonectria* is also represented in North America by a single species which is quite different from the species here described, not only in the presence of septate spores but in the size of both plants and spores as well.

Nectria semenicola sp. nov.

Conidial phase consisting of a white mycelial growth which covers the substratum, finally heaping up at various points forming pinkish stomata; conidiophores erect, much branched, branches ascending perpendicularly, bearing at their summits, elliptical, hyaline conidia; conidia 5–7 × 2–3 mic., with 1–2 oil-drops.

Perithecia cespitose in small, dense clusters, with numerous scattered individuals; clusters confluent, often covering the most

of the exposed surface of the seed; individual perithecia nearly globose, with a minute, papilliform ostiolum, smooth or nearly so, 250 mic. in diameter, at first orange, fading in drying to golden-yellow or whitish; asci clavate, 40–50 mic. long, 8-spored; spores mostly 2-seriate or irregularly crowded, hyaline, 1-septate, a little constricted at the septum, 10–14 × 3–3.5 mic.

On partially decayed seeds of skunk-cabbage (*Spathyema foetida*).

TYPE LOCALITY: New York City.

DISTRIBUTION: Known only from type locality.

The perithecia and spores of this species do not differ materially from some of the species of the genus which occur on bark of various trees. However, the habitat, which is in itself interesting, and the peculiar appearance of the conidial phase seem to distinguish this form from any of the species examined.

A specimen collected in the propagating house of the New York Botanical Garden on beans which had been used for experimental purposes and allowed to partially decay corresponds so far as we can see with those occurring on the seeds of skunk-cabbage.

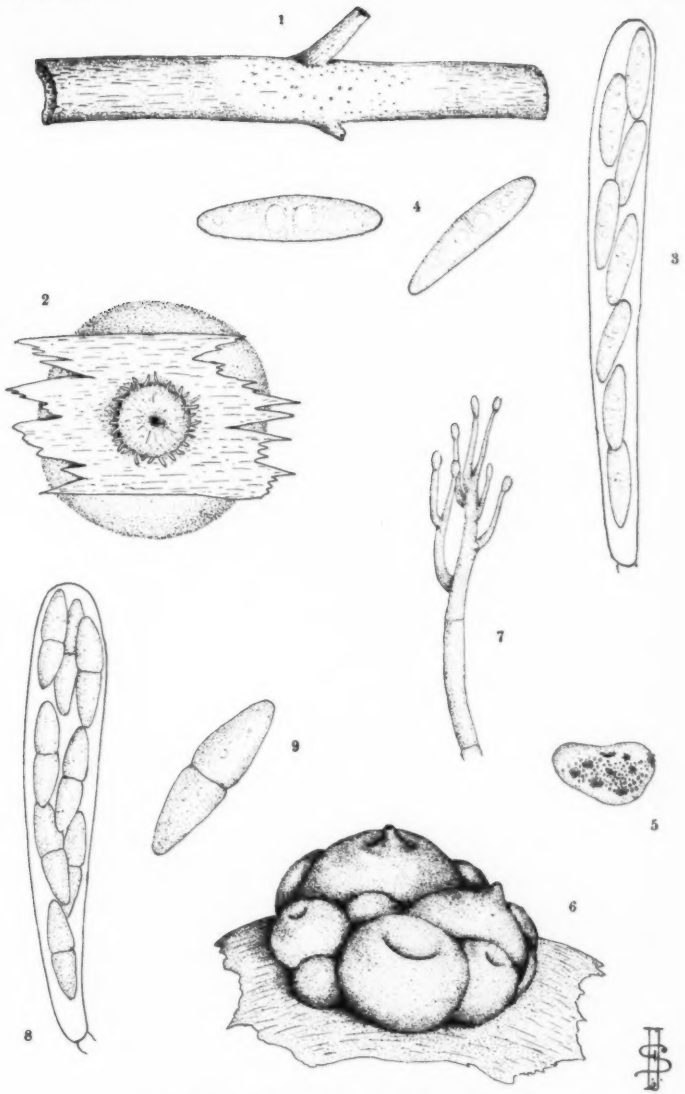
EXPLANATION OF PLATE II.

FIGS. 1–4. *Hyponectria dakotensis* sp. nov.

1. Habitat, showing plants natural size.
2. Ostiolum as it appears enlarged (surrounding epidermis diagrammatic).
3. Ascus with spores, × 2,000.
4. Two spores showing oil-drops within, × 2,500.

FIGS. 5–9. *Nectria semenicola* sp. nov.

5. Habitat, showing plants natural size.
6. Cluster of perithecia showing gross characters.
7. Conidiophore with conidia, × 400.
8. Ascus with spores, × 2,000.
9. A single spore, × 2,500.



1–4. HYPONECTRIA DAKOTENSIS Seaver

5–9. NECTRIA SEMENICOLA Seaver

A BACTERIAL DISEASE OF THE PEACH*

JAMES B. RORER

From time to time during the past five or six years peach growers in various sections of the country have called attention to a shot-hole disease of peach leaves which, in wet seasons at least, has caused a great deal of premature defoliation. In 1903 Mr. P. J. O'Gara, of the Bureau of Plant Industry, found it prevalent in Georgia and suggested that it was of bacterial origin. During the same season Clinton* observed a leaf-spot disease, evidently the same, in Connecticut, and noted it in his report for that year.†

It was again found in Georgia in 1905 by Mr. W. M. Scott, of the Department of Agriculture. In 1906, 1907, and also in the past season the writer, who undertook a somewhat detailed study of the disease found it to be prevalent throughout the South and Middle West, and, in those sections at least, it is the commonest shot-hole disease of peach leaves, the Cercospora leaf-spot being but rarely met with. That a bacterium caused the disease was proved by inoculation experiments. A bacterial disease of peach twigs and of the fruit was also found, and it seems probable that they, as well as the leaf-spot, are caused by the organism in question.

The form occurring on the leaves is by far the commonest and most wide spread. It causes somewhat angular, purplish-brown spots ⅛ to ¼ inch in diameter which, when infections have been numerous, coalesce so that quite large areas of the leaf may be involved. The diseased tissues soon fall out, giving a shot-hole effect. Leaves which are at all badly affected soon drop to the ground, so that the trees may become prematurely defoliated. This is especially true in orchards which have not been well pruned and cultivated.

In August, 1906, very small spots from fresh leaves were

* Paper read at the meeting of Section G, A. A. A. S., Baltimore, 1908.

† Rep. Conn. Agric. Exp. Sta. **26**: 337. 1903.

cut out, thoroughly washed, and then mashed up in sterile water, from which, by the poured-plate method, a yellow motile organism was isolated. Many of the plates proved to be pure cultures containing sometimes 100 or 200 colonies.

During the summer of 1907, a series of successful inoculations with this bacterium was made at Bentonville, Arkansas. Sterile water was added to pure cultures on slant agar five days old and with a sterile needle the bacterial growth was loosened from the surface of the medium and thoroughly mixed with the water. This liquid, containing bacteria in great numbers, was diluted a little and then sprayed with an atomizer on young Elberta peach leaves. This variety was chosen because it is naturally quite susceptible to the disease. Three sets of inoculations were made on different days and on different trees. From thirty to forty leaves were involved in each spraying. About an equal number of leaves on adjacent trees were sprayed with sterile water alone to serve as a check. The inoculations were made on June 25, 26 and 28. The trees inoculated on the two earlier dates were examined on July 15. From four to six spots of the characteristic appearance were found on most of the leaves which had been sprayed with the bacteria-bearing fluid, while the leaves sprayed with sterile water showed no spots at all. The leaves inoculated on June 28 were examined on July 20, and, as in the previous cases, the leaves which had been sprayed with the bacteria showed spots, three or four to a leaf, while the checks remained free. Sections of these spots on the inoculated leaves, when examined under the microscope, showed the characteristic cavities filled with bacteria and plates poured from the smallest spots were practically pure cultures of one organism, the motile yellow bacterium with which the inoculations had been made. Although in no case were the spots on the leaves as numerous as one might expect considering the large number of bacteria in the fluid used, the fewness of the spots may be accounted for by the fact that the weather conditions at the time were very unfavorable, there being scarcely any rainfall and but little dew, and no attempt whatever was made to keep the leaves moist after the inoculations were made. From these ex-

periments the conclusion may be drawn that this disease of peach leaves is caused by the yellow bacterium.

The disease as it occurs on the twigs was first observed by the writer at Siloam Springs, Arkansas, in 1907. It kills the bark of young shoots, forming purplish-black, slightly sunken areas usually $\frac{1}{8}$ to $\frac{3}{16}$ inch wide which may extend for two or three inches along the stem or even girdle it. At times the whole end of a shoot may be killed. The infections as a rule seem to take place at a leaf scar. The disease was found again last year in an orchard at Bentonville, Arkansas. In each case it was closely associated with the bacterial leaf-spot; in fact many of the diseased twigs had already been defoliated. Sections through the smallest spots showed that bacteria were present in enormous quantities in cavities in the bast tissue, and by the poured-plate method a yellow bacterium was isolated from these spots. The growth of this organism in various media, such as beef, rice and corn-meal agar and on potato cylinders, is similar to that of the organism isolated from the leaf-spots and the two organisms are evidently the same. No attempt has yet been made to produce the disease on the twigs by inoculation.

The disease as it occurs on the fruit is quite striking and exceedingly characteristic. It was found in two orchards at Bentonville during the past season. It causes a very small purplish spot over which the skin soon cracks either in a straight or angular way. The individual spots are scarcely ever much over $\frac{1}{16}$ of an inch in diameter but are usually very numerous (as many as 250 have been counted on one side of a peach), so that the cracks may become continuous and extend for an inch or more. Numerous sections through even the smallest of these spots showed that bacteria were present in enormous quantities and were evidently the cause of the trouble. Attempts to get pure cultures of the organism were not successful because of the cracks and the small size of the spots which made it impossible to sterilize the outside of the peach without killing the parasite, and when plates were poured from spots which had not been sterilized on the outside they became completely overrun with rapidly growing saprophytes. The reasons for assuming that

the organism isolated from the leaf-spot and the stem-spot is also responsible for this fruit-spot will be pointed out later.

As to the identity of the organism causing the leaf-spots there does not seem to be much doubt. Soon after the peach leaf-spots were first found, Dr. Erwin Smith suggested to the writer that *Bacterium pruni*, the organism causing the bacterial black-spot of plums and a plum leaf-spot, was the cause, and though this as yet has not been completely proved, all the work that has been done points to the truth of that suggestion. In the first place the hosts are closely related and have other diseases in common; then too the microscopic and macroscopic appearance of the peach leaf-spots is identical with that of the bacterial plum leaf-spots. For the past three months the organism isolated originally from peach leaf-spots and *Bacterium pruni* isolated from plum spots, have been grown side by side in different culture media, such as beef bouillon, nitrate bouillon, Uschinsky and Dunham solution, gelatin, beef agar, milk, litmus milk, and potato cylinders and in all the cultural characteristics are exactly the same. Finally, by inoculating with *Bacterium pruni*, spots may be produced on peach leaves similar in all respects to those resulting from natural infection and from artificial infection with the organism isolated from natural infection spots on the peach.* The only thing necessary to complete the chain is to produce the plum spots with the organism isolated from the peach leaf-spot.

Though the twig-spots have not yet been produced by inoculation the organism isolated from them has all the cultural characteristics of the leaf-spot organism so that it also may be considered to be *Bacterium pruni*.

As the fruit-spot was not discovered until the end of the peach season last year but little work has been done on it. Attention is called to it here because of its bacterial nature and its very characteristic appearance. It has not been produced by inoculation nor has the organism been isolated, but the spots

* In a paper entitled "Occurrence of *Bacterium pruni* on Peach Leaves," read before the Society of American Bacteriologists at the Baltimore meeting, Dr. Erwin F. Smith reported the results of inoculations with *Bacterium pruni* on peach leaves made in 1907–1908, which agree in every respect with those obtained by the writer.

are so strikingly similar in both microscopic and macroscopic appearance to the young bacterial spots on the plum, especially those resulting from late infections, that it may be safely assumed that *Bacterium pruni* is the cause of this disease also.

The writer is planning to continue the investigation of these diseases through another season in order to establish more definitely their relationship.

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THE PROBLEMS OF NORTH AMERICAN LICHENOLOGY

BRUCE FINK

Several years ago the writer gave an address, later published,* covering certain phases of the subject of this paper, and he will now attempt to cover other ground. Many of the lichenological problems which should claim some attention from American botanists are not strictly North American problems, but some of these must be considered as well as the problems that are more strictly American. Of problems which may be regarded more strictly ours as American botanists, we wish to consider several, without attempting to include all.

A matter of some importance is popularizing American lichenology without degrading it. This has been done for some other portions of our flora, and can be done for the lichens. However, the task is not an easy one, but requires the best effort of a trained botanist, who is at the same time a student of lichens. Such a work, with profusion of illustration and workable keys to families, genera, and species, would no doubt bring to lichenology many workers who could aid in making the flora of various regions known.

Careful studies are needed over our whole territory, in order that the lichens may be collected and become well known. Nor is it collecting alone that is wanted, good as that is, but we need workers who will both collect and study. Many have contributed largely by collecting and sending their collections to lichenists for study. Some of these persons have come to possess a fairly good knowledge of lichenology and have become sharp-eyed collectors. Nevertheless, the best collecting is done by persons who are making careful studies of the materials collected. One may, perhaps, be able to collect the larger and more easil distinguishable foliose or fruticose lichens without

* Fink, Bruce. Two Centuries of North American Lichenology. Proc. Iowa Acad. Sci. 11: 11–38. *pl. 1.* 1904.

so much careful microscopic work, but no one can hope to contribute largely to a knowledge of our crustose lichens, which are least known, without being a careful student of his material as well as a collector.

The thing most needed, however, for the systematist, is a reliable manual of North American lichens and monographs of the genera. The need of a manual is so great, that there would be ample excuse for one who might be inclined to undertake such a work to begin at once; but, in the present state of North American lichenology, the task could be only very imperfectly performed at best. There is not a monograph of a single genus of lichens for North America, though some monographs by Europeans treat our species in a very imperfect way. Nor can the monograph of the genus *Arthonia* by Henry Willey† be considered as more than a compilation. There is here a rich field for the trained systematist who has access to the centers of botanical activity, large herbaria and libraries. Without these facilities creditable work in systematic lichenology is no longer possible, whatever may be the ability and training of the worker.

Another matter of prime importance is the accumulation of a knowledge regarding the literature of American lichenology. There should be definite historical statement, a list of all species described as new from our territory, a list of all first mention of species from North America, a bibliography as complete as can be made, and even a compilation of all lists of lichens published as occurring on American territory. It is known to many workers that the writer has been at work on the bibliography and the listing of new species for several years. However, though the titles now number somewhat less than six hundred, every effort to close the work for publication has resulted in finding it too incomplete for that purpose. The larger and less interesting and useful task of compiling all lists published has not been attempted, though the writer is of the opinion that every worker in any field of botanical taxonomy should have such lists at hand, however imperfect the determinations may be upon which the lists rest, and however little confidence may be placed in

† Willey, Henry. A Synopsis of the Genus Arthonia. i–vi and 1–62. New Bedford, Mass., E. Anthony & Sons. 1890.

them without seeing the specimens listed. Finally, in default of a new manual of North American lichens, a compilation of descriptions of post-Tuckermanian new species would be well worth while. This, in turn, can be done only after one has at hand as reliable a bibliography as can be made.

A labor less distinctly American is that of typifying lichen genera. This problem may become distinctly one for Americans through failure of European lichenists to attack it. Our present knowledge of lichen genera is far from complete. Recent attempts to typify genera of American lichens has proven to the writer that all lists of lichen genera, Krempelhuber's* not excepted, fall far short of being complete. Krempelhuber gives approximately 750 lichen genera, and there are fully 250 more, some of which he either ignored in his compilation or did not know, while others have been proposed since 1870. An approximately complete list of lichen genera is to be had only by working over a vast amount of botanical literature, searching in obscure places as well as in publications better known. This involves an enormous amount of difficult literary work, besides thousands of critical examinations of specimens. Some examples of difficulties may be drawn from the writer's attempts to typify our lichen genera. However, before giving these instances of difficulties arising in attempts to typify genera according to the first species rule, the writer wishes to disavow any settled conviction on his part that this is the best method, nor does he care to be interpreted as being certain that it is best to abandon well established generic names in the interests of priority; he prefers to reserve judgment for the present. The illustrations are as follows:

Type species, *Amphiloma elegans* (Link) Fr. Körb. Syst. Lich. 110. 1855. But this is our *Placodium elegans*, and the name *Amphiloma* is invalid. Type species, *Pyrenula verrucosa* Ach. Lich. Univ. 314. *pl. 15. f. 1.* 1810. But this plant is a *Verrucaria*, and *Pyrenula* would be invalid, were not *Verrucaria*, in our present conception of the genus, invalid. But we have as

* Krempelhuber, A. von. Geschichte und Litteratur der Lichenologie 1: i–xv. 1–616. 1867; 2: i–viii. 1–776. 1869; 3: i–xvi. 1–261. 1872. München, C. Wolf & Sohn.

type species for *Verrucaria, Lichen cricetorum* L. Sp. Pl. **2**: 1141. 1753, which is, according to Wainio (Soc. Faun. Fl. Fenn. **14**: 20. 1888), identical with our *Icmadophila* (*Bæomyces*) *æruginosa,* which is in turn the type of *Ichmadophila* Ehrh. Beitr. Naturk. **4**: 147. 1789. Among foliose and fruticose genera we have *Physica fastigiata* (Pers.) Ach. Lich. Suec. Prod. 175, 255. 1798. = *Ramalina calicaris* (L.) Fr.; *Physcia* thus taking precedence over *Ramalina,* being the older name, though final disposition must as in all other similar instances await typification of all lichen genera. Again, the type of the well established genus *Rinodina* is *Rinodina atra* (Huds.) S. F. Gray, Nat. Arr. Brit. Pl. **1**: 448. 1821 (= *Lecanora atra*). *Lecanora,* being older, would replace *Rinodina* in strict application of the rules of priority, but examination of the writings of Acharius shows that he has placed *Gyalecta, Lecanora,* and *Parmelia* in a tangle by citing for types of all three genera lichens belonging to *Lecanora,* according to the modern conception of that genus, based upon the author's type. Lack of space forbids a discussion of the status of the three genera; and further instances of difficulties met in typifying lichen genera without full knowledge of all the genera would be out of place here.

The work of typifying lichen species is quite as important. We can not arrive at anything like finality regarding our species until the types, largely in European herbaria, have been examined. We have more or less of synonymy, largely handed on from author to author, but synonymy given by any author may be regarded as unreliable, unless based upon the examination of type specimens by him. Indeed, the sooner the practice of copying citations and long lists of synonyms from other authors is abandoned the better. An author may be pardoned for citing the first name of a species, since this seems necessary, but he had better stop there unless he has seen the type specimens upon which his synonymy rests.

In conclusion, some problems not distinctively American may be discussed briefly. First among these we shall consider lichen ecology. Dr. H. C. Cowles* has well said: "The speaker has

* Cowles, H. C. The Work of the Year 1907 in Ecology. Science **19** (N. S.): 879–925. 1904.

long felt that lichens are among the most interesting of plants ecologically, because they are so closely related to the unmodified physical environment." A few papers on lichen ecology have appeared in our country, and the writer has noted European papers bearing ecological titles, not to include many others which have an indirect bearing, but which may none the less prove more valuable to the ecologist in the long run. The American work is but a beginning, and much of it surely will not endure the testing of ecology now in progress, but the field is a most fruitful and inviting one and should attract some competent workers.

We can only mention some other problems not strictly American. A proper classification of lichens must rest upon a better knowledge of general morphology of these plants than we now possess, a sufficient understanding of the symbionts and their phylogeny, a more thorough study of the physiological relationship of the symbionts and a more widely extended and more minute study of the sexual reproductive tracts in these plants.

OXFORD, OHIO, January 24, 1909.

NEWS AND NOTES

A recently published list of registered investigators at the New York Botanical Garden during the first ten years of its history shows that nearly 25 per cent. of these investigators devoted all or most of their time while in residence to the study of fungi.

A summary of botanical work at the New York Agricultural Experiment Station from 1882 to 1907, by F. C. Stewart, indicates the great advances made in plant pathology since the discovery of bordeaux mixture in France and the establishment of agricultural experiment stations throughout the United States.

Dr. and Mrs. W. A. Murrill returned from Jamaica, January 27, with a large collection of fleshy fungi. Collections were made at fourteen different points on the island, from sea level to elevations of over six thousand feet. Copious notes and colored illustrations were obtained from specimens in a fresh condition.

The Journal of the New York Botanical Garden for December contains an article of several pages on the edible fungi of Bronx Park, illustrated by two plates containing twelve figures, five of which are colored.

Nine parts of North American Flora have been issued to date, four of which are mycological in character. Vol. 7, part 1, contains descriptions of the families Ustilaginaceae and Tilletiaceae, by G. P. Clinton; vol. 7, part 2, the Coleosporiaceae, Uredinaceae and Aecidiaceae (pars), by J. C. Arthur; and vol. 9, parts 1 and 2, the Polyporaceae, by W. A. Murrill.

An important addition to the literature of the fleshy fungi has recently been made by Miss Gertrude Burlingham, now of the Eastern High School, Brooklyn, who was a student at the Garden and Columbia University from 1905 to 1908, during

which time she made an exhaustive study of the Lactariae, or gill-fungi having a milky juice. The results of her studies appeared May 26 as a memoir of the Torrey Botanical Club (**14**: 1–109. *f.* 1–15. 1908). The descriptions and notes are very complete, and the illustrations, from photographs by the author, are excellent. A feature of great value to collectors is a condensed description of each species when fresh with distinguishing characters to be used in the field. Seventy-one species are recognized in the United States, six of these being described as new.

The Bulletin of the University of Wisconsin, issued in August, 1908, contains the results of a series of infection experiments with *Erysiphe Chicoracearum* D.C. which were obtained by Dr. G. M. Reed. It has been previously shown that among the mildews a single morphological species may consist of several physiologically distinct forms limited in their occurrence to a single host or several closely related hosts. As a result of the experiments on the above named powdery mildew, seventeen species and varieties of cucurbits are added to the list of the host plants of this fungus. It is also shown that the biologic form of *E. Chicoracearum* D.C. occurring on so many cucurbits is not confined to the species of this family. The results of the many inoculation experiments are carefully tabulated in this paper, furnishing a reliable basis for the conclusions drawn by the author. The conclusions of various writers in regard to physiological forms of parasitic fungi are reviewed. It is supposed that these physiological forms represent the first stages in the evolution of species morphologically distinct.

The October number of Annales Mycologici contains a monograph of the North American Geoglossaceae by Dr. E. J. Durand, of Cornell University. The author recognizes for this family of discomycetous fungi in North America eleven genera, forty-two species and two varieties. In addition to this number, eleven species have been reported from North America which are not well known. One new genus and nine new species are described.

The paper is accompanied by eighteen plates, containing, in all, two hundred and twenty-two figures, consisting of camera lucida drawings, photographs and microphotographs illustrating characters which are of importance in the diagnosis of the various genera and species. This monograph represents a very thorough piece of work, since practically all of the existing types of the species described have been examined, and it therefore furnishes a reliable basis for future work on this attractive group of plants in which the flora of North America is said to be especially rich.

At a meeting of plant pathologists called at Baltimore, December 30, 1908, in connection with the meeting of the American Association for the Advancement of Science, Prof. A. D. Selby, of the Ohio Experiment Station, was elected temporary chairman, and Mr. Donald Reddick, temporary secretary. The temporary committee, appointed at Washington, December 15, consisting of C. L. Shear, Donald Reddick and W. A. Orton, presented its report recommending that an organization of American plant pathologists be perfected.

The report of the committee was accepted and temporary organization was effected by the unanimous election of the following officers:

President—Professor L. R. Jones, Vermont Agricultural Experiment Station.

Vice-President—Professor A. D. Selby, Ohio Agricultural Experiment Station.

Secretary-Treasurer—Dr. C. L. Shear, U. S. Department of Agriculture.

Councilmen—Professor J. B. S. Norton, Maryland Agricultural Experiment Station; Professor B. M. Duggar, Cornell University Agricultural Experiment Station.

The five officers elected form a council which is to consider and make recommendations in regard to all questions relating to the permanent organization, policy and affiliation of the society.

The next meeting will be called at such time and place as may be decided by the council.

It is well known that practically all of the chestnut trees in and about New York City have been killed within the past few years by the chestnut canker, *Diaporthe parasitica;* but the number of trees destroyed has been only very roughly estimated. Through the efforts, however, of Mr. J. J. Levison, arboriculturist of the parks of Brooklyn, who has made a careful survey of Forest Park, it is now known that 16,695 chestnut trees were killed in the 350 acres of woodland in this park alone. Of this number, about 9,000 were between eight and twelve inches in diameter, and the remaining 7,000 or more were of larger size.